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WASTE WATER TREATMENT

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(57) Claim

1. A waste water treatment apparatus of the kind comprising at least one initial treatment chamber wherein the waste water is mixed with a flocculating agent to transform pollutants in the waste water into floccules, and an air flotation chamber wherein the floccules produced in the initial treatment chamber are separated off, characterised by means to feed a pressurised aerating solution of air in water into said initial treatment chamber.

6. A method of treating waste water of the kind comprising the steps of mixing the untreated waste water with a flocculating agent to transform pollutants in the waste water into floccules, treating the waste water and floccules in a dispersed air flotation chamber to cause or allow the floccules to migrate to the surface of the liquid in that chamber, and separating the floating floccules from the water, characterised in that a pressurised aerating solution of air in water is mixed with said waste water in conjunction with said flocculating agent to cause air bubbles to be trapped within the floccules as the floccules are formed.

AUSTRALIA  
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**ORIGINAL  
COMPLETE SPECIFICATION  
STANDARD PATENT**

Invention Title: WASTE WATER TREATMENT

The following statement is a full description of this invention, including the best method of performing it known to the Applicant:-

This invention relates to the treatment of waste water for the removal of particulate and other non-soluble pollutants. Typically the invention is applied to the treatment of industrial process effluents before the discharge of the treated effluent into municipal sewer systems and  
5 the like.

More particularly, the invention relates to such treatment by the so-called Dispersed Air Flotation (DAF) process, wherein the waste water is mixed with coagulating and/or flocculating agents in an initial treatment chamber, to cause the suspended pollutants to coalesce into  
10 flocules, and is then fed into a DAF cell for the separation of the flocules from the water.

The DAF cell comprises a flotation chamber, wherein rising air bubbles carry the floccules to the surface to form a froth or scum, and conveyor or skimmer means whereby the froth or scum is mechanically removed before the treated waste water is discharged.

5 In DAF cells of advanced design, as exemplified in the cell described in the complete specification of our co-pending Australian patent application No. 618454 (previously 50547/90), the air is liberated in the flotation chamber as very small bubbles. This is achieved by dissolving air in water under pressure and liberating streams or jets of  
10 the air/water solution into the flotation chamber. As a result, minute widely spaced bubbles of air are formed as the air comes out of this aerating solution because of the drop in liquid pressure. The bubble formation is quite analogous to that commonly observed upon the removal of the cap from a bottle of soda water or other, so-called,  
15 aerated beverage.

The present invention is based on the discovery that if a similar aerating solution under pressure is introduced into the initial treatment chamber along with the flocculating agent or agents, then the minute bubbles formed in the initial treatment chamber serve as seeding sites  
20 for the flocculation. They thereby increase the efficiency of the flocculating agents and, more importantly, become trapped in or incorporated with the floccules. This materially decreases the density of the floccules and enhances the ability of the air in the flotation chamber to lift them to, and/or keep them at, the surface until removed.

25 Therefore the invention consists in a waste water treatment apparatus of the kind comprising an initial treatment chamber wherein the waste water is mixed with a flocculating agent to transform pollutants

in the waste water into floccules, and an air flotation chamber wherein the floccules produced in the initial treatment chamber are separated off, characterised by means to feed a pressurised aerating solution of air in water into said initial treatment chamber.

5        The invention also consists in a method of treating waste water of the kind comprising the steps of mixing the untreated waste water with a flocculating agent to transform pollutants in the waste water into floccules, treating the waste water and floccules in a dispersed air flotation chamber to cause or allow the floccules to migrate to the  
10 surface of the liquid in that chamber, and separating the floating floccules from the water, characterised in that a pressurised aerating solution of air in water is mixed with said waste water in conjunction with said flocculating agent to cause air bubbles to be trapped within the floccules as the floccules are formed.

15        In preferred embodiments wherein the air bubbles in the flotation chamber are provided by releasing a high pressure aerating solution into the flotation chamber, the aerating solution acting as the vehicle for the flocculating agent may simply be bled from the source of the aerating solution for the flotation chamber.

20        In other embodiments a separate supply of pressurised, aerating solution may be used.

      The flocculating agent may be mixed with the aerating solution in the same way as it is normally mixed with water before delivery into the initial treatment chamber, or the flocculating agent and the pressurised  
25 aerating solution may be fed into the initial treatment chamber simultaneously for admixture therein.

By way of example, an embodiment of the above described invention is described in more detail hereinafter with reference to the accompanying single figure drawing, which is a diagrammatic plan view of a dispersed air flotation cell and its ancillaries according to the invention.

The illustrated apparatus comprises a DAF cell comprising a tank divided into a number of chambers by internal partitions or weirs, namely three initial treatment chambers 1, 2 and 3, a holding chamber 4, a flotation chamber 5, a return well 6 and an outlet chamber 7. Waste water to be treated is pumped into the initial treatment chamber 1 and the heights of the weirs separating the various chambers are such that the water may cascade by overflow through those chambers 1 to 5 in that order. The well 6 is open at its bottom to the flotation chamber 5 and is separated from the outlet chamber 7, from which treated water is drained or pumped, by a preferably adjustable weir 8 that determines the liquid level in the flotation chamber 5.

The flotation chamber 5 is fitted with conventional skimmer and removal means (not shown) whereby scum or froth floating on the liquid in that chamber is scraped up a ramp 9 into a trap 10 for removal.

In the present instance the air bubbles in the flotation chamber 5 are produced by liberating a pressurised aerating solution from three perforated distributor pipes 11 extending across the floor of the chamber. Those distributor pipes are fed from a retention vessel 12 storing pressurised solution. The vessel 12 is itself fed and pressurised by a high pressure centrifugal pump that draws clean or treated water from the outlet chamber 7. Air is incorporated in the water supplied to the retention vessel 12 by an induction device 13 optionally associated

with the intake line or output line of the pump 13, depending on the open or closed state of control valves 14 and 15. That air dissolves rapidly in the water in the vessel 12 under the pressure pertaining therein.

- 5        Insofar as it has been described above the illustrated apparatus is prior art, but, in accordance with the invention, a valve controlled solution supply pipe 16 is provided whereby pressurised aerating solution is liberated into the initial treatment chambers 1 and 2.

10        The operation of the illustrated apparatus is as follows. The raw waste water to be treated is fed into the initial treatment chamber 1 along with a coagulant and flocculating agent of known kind in conventional manner. The liquid in the chamber 1 is stirred and, due to the release of solution therein, multitudes of small bubbles are formed in the chamber. Those bubbles become trapped in the forming floccules.

- 15        The liquid overflows into initial treatment chamber 2, wherein further or different coagulating agent may be added. The liquid then overflows into initial treatment chamber 3 wherein flocculant or any other treating agent may be added depending on the nature of the pollutants in the waste water being treated.

- 20        It takes some time for the floccules to form and for the air bubbles to become incorporated in them. Therefore, the holding chamber 4 is preferably provided intermediate the initial treatment chambers and the flotation chamber 5. In this event waste water in admixture with partly formed floccules overflows from the initial treatment chamber 3 into the  
25        holding chamber 4. Here, under relatively quiescent conditions, the



formation of the floccules, and the incorporation of air bubbles in them, is completed.

The water and floccules are less agitated in the holding chamber 4 than they are in the initial treatment chambers, and, as a result, a high proportion of the floccules come to the surface in the holding chamber 4. The contents of the holding chamber 4 may be allowed to overflow gently into the flotation chamber 5 so that much of the flocculent material moves directly onto the surface of the liquid in the flotation chamber, thereby improving the efficiency of the flotation chamber by reducing the amount of material that has to be brought to the surface in it.

For preference an oxidising agent is added to the waste water in one or other of the initial treatment chambers. This may be conveniently achieved by supplying ozone from an ozone generator 17 to the eductor 13 for inclusion with the air in the aerating solution.

**THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:-**

1. A waste water treatment apparatus of the kind comprising at least one initial treatment chamber wherein the waste water is mixed with a flocculating agent to transform pollutants in the waste water into  
 5 floccules, and an air flotation chamber wherein the floccules produced in the initial treatment chamber are separated off, characterised by means to feed a pressurised aerating solution of air in water into said initial treatment chamber.
2. Apparatus according to claim 1 further comprising a holding  
 10 chamber intermediate said initial treatment chamber or chambers and said flotation chamber wherein the formation of floccules is substantially completed before the waste water enters the flotation chamber.
3. Apparatus according to either claim 1 or claim 2 wherein  
 15 said aerating solution is produced by pumping a mixture of air and water into a retention pressure vessel.
4. Apparatus according to claim 4 further comprising an ozone generator and means to introduce the ozone produced thereby into said aerating solution.
5. Apparatus for the dispersed air flotation treatment of waste  
 20 water substantially as described herein with reference to the accompanying drawing.
6. method of treating waste water of the kind comprising the steps of mixing the untreated waste water with a flocculating agent to transform pollutants in the waste water into floccules, treating the waste



water and floccules in a dispersed air flotation chamber to cause or allow the floccules to migrate to the surface of the liquid in that chamber, and separating the floating floccules from the water, characterised in that a pressurised aerating solution of air in water is mixed with said waste  
5 water in conjunction with said flocculating agent to cause air bubbles to be trapped within the floccules as the floccules are formed.

7. A method according to claim 6 further comprising the step of adding an oxidising agent to said aerating solution.

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